NDIDATE'S
NUMBER

or the use of the Department only)

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Physics 30
1966

DEPARTMENT
EDUCATION ALBERTA

HIGH SCHOOL AND UNIVERSITY MATRICULATION EXAMINATIONS BOARD

DEPARTMENTAL EXAMINATIONS, 1966

PHYSICS 30

Time — 3 hours.

Total Possible Mark — 154.

DO NOT SPEND TOO MUCH TIME ON ANY ONE QUESTION.
READ THE QUESTIONS CAREFULLY.

Mathematical tables, slide rules and geometry sets may be used.

Complete solutions must be shown for all problems.

Rough and finished work may be done in pencil or ink (Blue or Black).

DO NOT FOLD THIS BOOKLET.

Place your test booklet in the answer envelope in such a way that the UPPER LEFT HAND CORNER OF THE BOOKLET (Candidate's Number) shows through the SLASHED CORNER of the answer envelope.

BE SURE TO SEAL THE ENVELOPE.

Constants:

J = 778 ft lb wt/BTU or 4.2 joules/cal.
g = 980 cm/sec^2 or 32 ft/sec^2
One horsepower = 550 ft lb wt/sec or 746 watts

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CURR HIST

(For the use of Sub-examiners only)

ROUGH WORK ONLY
(No marks given for work in this space)

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QUAECUMQUE VERA

Values

3 **1.** On a trip of 260 miles a motorist averages 45 mph for the first 120 miles and 60 mph for the next 140 miles. What was the average speed over the entire trip?

2. A man is on a passenger coach which is travelling at 12 mph. He crosses over to the other side of the coach at 5.0 mph in a direction perpendicular to the motion of the train.

2 (a) What is the speed of the man relative to the ground?

2 (b) Find the angle between the path of the man relative to the ground and the direction the train is moving.

[OVER]

ROUGH WORK ONLY

(No marks given for work in this space)

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Values

3. A force of 1250 lb wt accelerates a car of mass 4000 lb. The car attains a speed of 75 mph starting from rest.

2 (a) What is the acceleration of the car?

2 (b) How long will it take the car to attain this speed?

2 (c) What distance will the car travel during this time?

2 (d) Find the ratio of the momentum of this car travelling at 75 mph to its momentum when it is travelling at 45 mph.

4. A motor with an output of 20 hp lifts an elevator of mass 2200 lb a certain distance in 15 sec at constant speed.

2 (a) What is this distance?

2 (b) What is the work done on the elevator?

ROUGH WORK ONLY

(No marks given for work in this space)

Values

4 **5.** A stone is thrown horizontally with a velocity of 12 ft/sec from the top of a building 400 ft high. How far from the base of the building will it land?

4 **6.** A stone is projected upwards from the top of a building 800 ft. high. Its vertical velocity when it leaves the top of the building is 80 ft/sec. How many seconds later will the stone land on the ground near the base of the building?

ROUGH WORK ONLY

(No marks given for work in this space)

Values

7. A body of mass 50 lb is suspended 49 ft above the ground.

2 (a) What is its potential energy?

2 (b) If it is allowed to fall, what will be its velocity just before it hits the ground?

2 (c) If all its kinetic energy is turned into heat energy when it hits the ground, how many B.T.U.'s of heat are developed?

3 **8.** Find the length in feet, of a pendulum whose period of vibration is 3.0 sec. (Use $\pi^2 = 10$).

2 **9.** Compare the period of vibration of a pendulum on the moon with the period of vibration on the same pendulum on earth. Your weight on the moon would be about one-sixth that on earth.

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ROUGH WORK ONLY

(No marks given for work in this space)

Values

4 **10.** A trolley of mass 360 gm is sliding along a smooth plane with a velocity of 25 cm/sec. It collides with a second trolley, initially at rest. The two, now coupled together, have a velocity of 18 cm/sec. Assuming no energy loss, what is the mass of the second trolley?

4 **11.** (a) A block of mass 120 lb rests on a plane inclined at 30° to the horizontal. If the coefficient of friction is 0.25, find the force required, parallel to the plane, to move the block up the plane with uniform velocity.

2 (b) Draw a diagram showing all the forces.

4 **12.** How many joules of work are done when 2.0 kg are lifted through a distance of 5.0 m?

ROUGH WORK ONLY

(No marks given for work in this space)

Values

6 **13.** A traffic light weighs 120 lb wt. It hangs from the center of a cable 120 ft long. This causes the cable to sag 4.0 ft from the horizontal position. What is the tension in the cable? (A scale diagram may be used.)

14. A piece of aluminum whose specific gravity is 2.7 weighs 40.5 gm wt in air.

2 (a) What would it weigh in water?

2 (b) What would it weigh in a liquid of specific gravity 0.80?

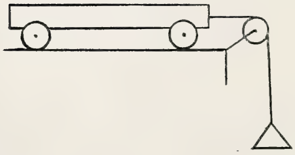
ROUGH WORK ONLY

(No marks given for work in this space)

Values

6 **15.** A log, AB, 30 ft long, weighs 200 lb wt and is slightly tapered. A weight of 70 lb wt is suspended from the log 10 ft from A. Another weight of 40 lb wt is suspended 5.0 ft from B. If the log is supported at A it is found that a force of 150 lb wt applied vertically at B is required to lift it. Where is the center of gravity of the log?

16. A trolley weighing 20 lb wt is pulled along a horizontal plane by a weight as shown in the diagram. The acceleration of the system is 7.0 ft/sec/sec?



3 (a) What is the weight of the body accelerating the system?

3 (b) Find the tension in the string.

ROUGH WORK ONLY

(No marks given for work in this space)

Values

3 **17.** If a given mass of gas occupies 400 cc at 20° C. 500 cc at 100° C., find its coefficient of volume expansion at 0° C. assuming the gas expands uniformly and the pressure remains constant.

3 **18.** When the bulb of a constant volume air thermometer is placed in melting ice at 0° C., the mercury level in the open tube is 7.0 cm below the constant volume mark. When the bulb is placed in boiling water at 100° C., the mercury level is 18 cm above the constant volume mark. The barometer reads 76 cm. Find the coefficient of increase of pressure at constant volume.

3 **19.** An air column 30 cm long is trapped in a narrow uniform glass tube between a closed end and a mercury pellet, 10 cm long, when the tube is held vertically with the closed end downwards. What will be the length of the air column when the tube is inverted? Atmospheric pressure = 72 cm.

ROUGH WORK ONLY

(No marks given for work in this space)

Values

2 **20.** Calculate the mass of a metal which has the same thermal capacity as one liter of water. The specific heat of the metal is 0.056.

3 **21.** 30 gm of water of 40° C. are poured into 70 gm of water at 15° C. contained in a metal calorimeter. Calculate the water equivalent of the calorimeter if the final temperature is 22° C.

5 **22.** A block of ice at –5.0° C. and mass 200 gm is put into a calorimeter containing water at 0° C. How long will it take to melt the ice if steam at 100° C. is passed into the calorimeter at the rate of 1.5 gm/ min? The water equivalent of the calorimeter is 10 gm; the specific heat of ice is 0.50; the heat of fusion of ice is 80 cal/gm; the heat of vaporization of water is 540 cal/gm.

ROUGH WORK ONLY

(No marks given for work in this space)

Values

6 **23.** A brass drum of circumference 42 cm with a mass of 200 gm contains 100 gm of water and is driven against a silk band, one end of which carries a mass of 2000 gm while the other is attached to a spring balance which reads 200 gm wt. Calculate the rise in temperature of the water in 10 min, if the drum rotates at 2 revolutions/sec. The specific heat of brass is 0.10. The mechanical equivalent of heat is 4.2 joules/cal.

6 **24.** How many kilowatts of power will a power plant deliver if its boilers and steam turbines have a combined efficiency of 18% while using 10^5 cu ft of natural gas per hour. One cubic foot of natural gas provides 2.5×10^5 cal and the mechanical equivalent of heat is 4.2 joules/cal.

ROUGH WORK ONLY

(No marks given for work in this space)

Values

25. 6.0×10^5 ergs of work are done in taking a charge of 0.30×10^9 electrostatic units from ground to a positively charged plate.

3 (a) What is the potential of the plate?

1 (b) What is the sign of the charge, positive or negative?

26. Three charges of +10, –20, and +20 electrostatic units are placed in the same straight line so that the –20 esu, which is in the middle, is 10 cm from each of the others. The dielectric is air.

4 (a) What is the net force on the middle charge due to the other two charges?

2 (b) What would be the effect on this net force if the middle charge were doubled and the charges were put in a fluid of dielectric constant 1.5 instead of air?

ROUGH WORK ONLY

(No marks given for work in this space)

Values

27. 1.4 gm of a certain metal is liberated by a 5.0 amp current flowing for 100 min.

2 (a) What is the flow in coulombs?

2 (b) Calculate the electrochemical equivalent of the metal.

3 (c) Find the valance if the atomic weight of the metal is 13.5.
(One faraday = 96,500 coulombs)

28. A voltmeter produces a full-scale deflection with a current of 0.10 amp.

2 (a) If the maximum reading is 10 volts, what is the resistance of the meter?

2 (b) How could the voltmeter be modified so that the maximum reading is 120 volts?

ROUGH WORK ONLY

(No marks given for work in this space)

Values

3 **29.** What length of wire of cross sectional area 3.0 sq mm and specific resistance 5.0×10^{-5} ohm-cm is necessary to make a resistance of 2.0 ohms?

4 **30.** When an external resistance of 2.3 ohms is connected to a cell, the potential difference across the resistance is 1.15 volts. When the external resistance is increased to 3.0 ohms, the potential difference across it is 1.2 volts. Find the E.M.F. and internal resistance of the cell.

ROUGH WORK ONLY

(No marks given for work in this space)

Values

31. Three resistances of 10, 2.0 and 2.5 ohms respectively are connected in parallel. This group is connected in series to a battery of internal resistance 1.0 ohm and another resistance of 3.0 ohms. The E.M.F. of the battery is 12 volts.

2 (a) What is the current in the battery?

2 (b) What is the difference in potential across the 3.0 ohm resistance?

2 (c) What is the difference in potential across the 2.5 ohm resistance?

2 (d) What is the current in the 2.0 ohm resistance?

2 (e) What is the current in the 10 ohm resistance?

2 (f) If the 3.0 ohm resistance is replaced by one twice as large, a 6.0 ohm resistance, what will be the current in this new resistance?

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DEPARTMENTAL EXAMINATIONS GRADE
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ROUGH WORK ONLY

marks given for work in this space)

LB 3054 C2 D419 1966 phy.30
Departmental examinations,
[grade 12] 1966. -

39780820 CURR HIST

Values

2 **32.** How is the E.M.F. induced in a coil affected when the number of turns of the coil is doubled?

2 **33.** What are eddy currents? How may their effect be reduced?

34. An electric toaster which is rated at 900 watts is connected to a 110 volt line.

3 (a) How many calories of heat are produced in 0.50 min?

2 (b) How much does it cost to make toast for the month if it takes 50 min at 4.0 cents per kilowatt-hour?